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## A retrospective study of the presentation, diagnosis and management of 16 cats with otitis media, not due to nasopharyngeal polyp

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Keywords: Otitis, otitis externa, otitis media, feline, infection, surgery, medical management

### Abstract

#### Objectives

The aim of this study was to analyse retrospectively cats diagnosed with otitis media not due nasopharyngeal polyp, and to review the clinical outcome with surgical and medical management.

#### Methods

Patient records were searched for cats diagnosed with otitis media (OM). The diagnosis was based on the presence of clinical signs, including neurological signs, respiratory signs and signs of otitis externa, and on the presence of thickened or irregular bullae walls, the presence of fluid within the tympanic cavity (TC), in those that had diagnostic imaging and in those that did not, with the presence of fluid in the bulla or organisms cultured, based on myringotomy. These records were analysed retrospectively.

#### Results

Out of 16 cats, one had a total ear canal ablation, five had ventral bulla osteotomy surgery and 11 were medically managed. Of the cats that were medically managed, using either topical products, systemic antimicrobials or a combination of both, eight had complete resolution of clinical signs.

#### Conclusions and relevance

This small cohort shows that some cats with otitis media can be successfully managed medically. Surgery is invasive and may not necessarily be required if appropriate medical management is undertaken. This is the first study of otitis media treatment in cats and provides the basis for further studies, which should aim to establish specific infectious causes of OM and how they can potentially be managed with medical therapies.

## Introduction

Otitis media (OM) is defined as inflammation of the middle ear; the tympanic bulla (TB), up to and including the tympanic membrane (TM). It is less common than otitis externa (inflammation of the external ear canal and pinna) (OE) and is less common in cats than in dogs.<sup>[1]</sup> Due to the inaccessibility of the middle ear, OM can be challenging to diagnose and treat.

The feline middle ear consists of the TB; the bony shell, the tympanic cavity (TC) within, and the TM, which separates the middle ear from the external ear. Unlike in dogs, the TC is divided by a septum of bone, creating two compartments. The septum runs from mid-rostral to mid-lateral and has a small gap dorsally, allowing communication between the two compartments.<sup>[2][3]</sup> In one review, both compartments were affected more commonly (94%) than either the ventromedial or dorsolateral compartments alone (6%).<sup>[4]</sup> This structural difference to dogs may potentially make treatment more challenging in cats.

A variety of clinical signs are associated with OM in cats. Otitis externa and signs of upper airway obstruction (inspiratory noise, nasal discharge, and dyspnoea) are common, along with signs of vestibular disease including head tilt, circling, nystagmus and ataxia.<sup>[5][6][7]</sup> Cats presenting with ipsilateral Horner's syndrome are common, due to damage to the palpebral branch of the facial nerve.<sup>[8][9][10]</sup> Non-neurological, non-specific clinical signs may include head shaking, pruritus, pain and altered ear carriage.<sup>[7]</sup> Hearing deficits have also been reported in cats, due to fluid in the TB or damage to the ossicles of the middle ear.<sup>[5][11]</sup>

There are several methods of diagnosing OM in cats. Because of their relatively short external ear canal, visualising the TM using otoscopy is relatively easy. Radiography, computed tomography (CT) and magnetic resonance imaging (MRI) are commonly used, with CT and MRI being considered more sensitive.<sup>[12]</sup> Myringotomy can also be useful to collect diagnostic samples from the TB.<sup>[13]</sup> OM in cats most commonly presents due to a nasopharyngeal polyp (NPP) or pharyngeal or upper respiratory infection which has extended up through the Eustachian tube. Less commonly OM occurs as an extension of OE and it has also been suggested that a potential cause could be haematogenous spread.<sup>[14][15]</sup>

Otitis media can either be managed medically or surgically.<sup>[16]</sup> In cats there is little if any information regarding medical management of otitis media not caused by a nasopharyngeal polyp and it has been suggested that there is an increased risk of ototoxicity in cats compared to dogs when using topical medications.<sup>[5][17]</sup> The aim of this study was to analyse retrospectively cats diagnosed with OM not due to NPP, and look at the clinical outcome with surgical and medical management. The authors hoped to provide some recommendations for treating OM in cats not caused by NPP.

## Methods

A search was performed in the practice management computer record system, using the keywords 'CT bullae' and 'otitis media', for feline patients. The results were then analysed to check that they fit the criteria; namely cats of any age that had been referred with or diagnosed at the hospital with OM. Cats with only a presumed diagnosis were excluded, as were those that had CT scans of their bullae for reasons

other than OM, such as traumatically avulsed ear canals. Any cat with mention of a middle ear polyp, nasopharyngeal polyp or 'soft tissue-attenuating material' in the bulla was also excluded.

The diagnosis of OM was based on the presence of clinical signs including neurological signs, respiratory signs and signs of otitis externa, and on the basis or evidence of thickened or irregular bullae walls, or the presence of soft tissue or fluid within the TC, in those that had diagnostic imaging, and in those that did not, with the presence of fluid in the bulla or organisms cultured, on myringotomy.

The case files were then analysed and data entered onto a spreadsheet (Excel, Microsoft, 2013). Clinical signs at first presentation were noted, diagnostic techniques employed at the referring practice and the referral hospital, and treatments prescribed. Descriptive statistics were derived from these data using simple percentages. The referring veterinary practice was contacted by telephone to request an up-to-date clinical history for each cat, since its referral.

## Results

### Signalment

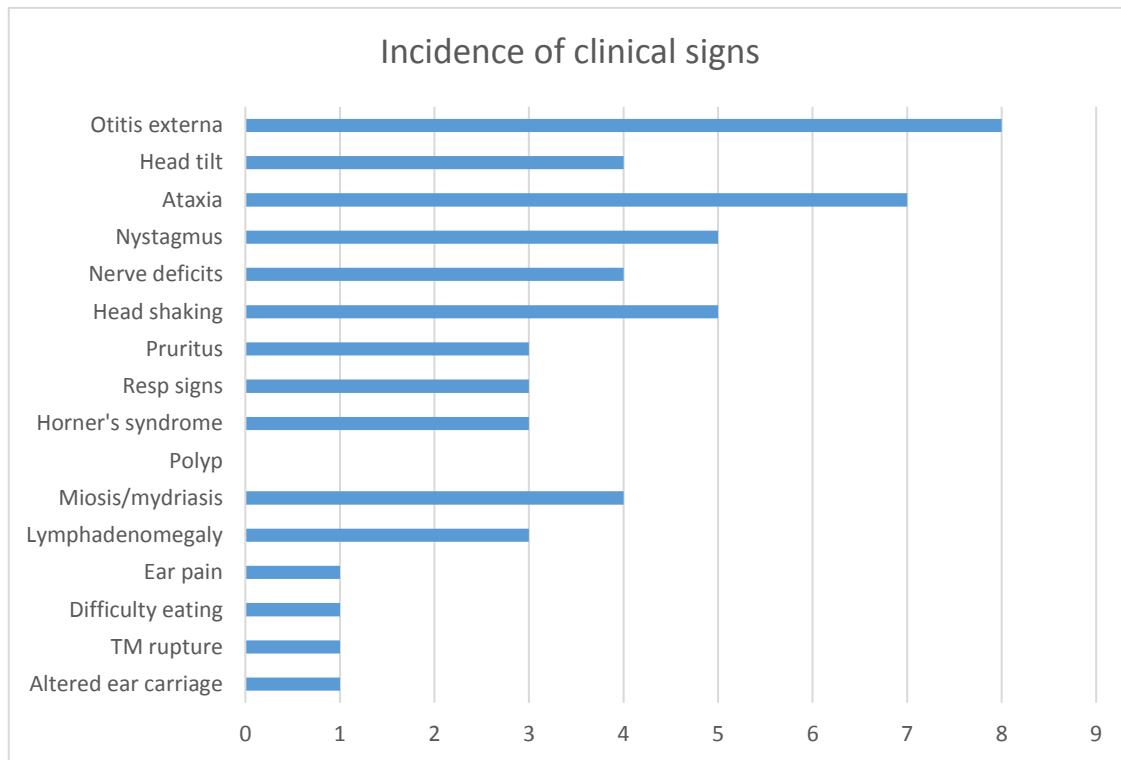
A total of 16 cases were diagnosed with OM between 2011 and 2016, of which 50% were unilaterally affected and 50% had bilateral OM.

The majority were under ten years of age (5/16, 31.3% under five and 7/16, 43.8% aged six to ten, 12/16 were less than ten years old). An equal number were male and female, most of which were neutered. The most commonly seen breed was the Domestic Shorthair (11/16, 68.9%). Other breeds seen were Domestic Longhair, Siamese, Maine coon, British Shorthair and Burmese.

### Presentation

Half of the cats seen at the referral hospital had shown signs of OE either at the referring veterinary surgery or on presentation at the hospital, of which four had concurrent neurological signs. Figure 1 shows the clinical signs observed in the cats included in the study. A high proportion of cases (11/16, 68.9%) presented with neurological signs, of which four had OE and neurological signs concurrently.

**Figure 1** – Summary of the clinical signs recorded for 16 cats with a diagnosis of otitis media



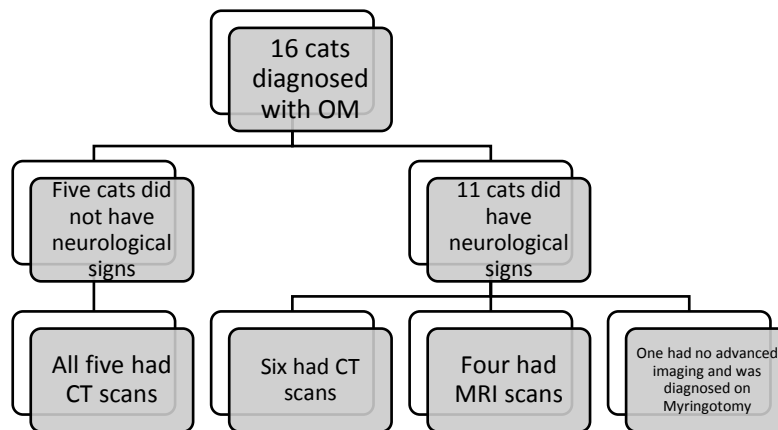
TM Rupture - Tympanic membrane rupture

#### Diagnostic investigations/tests at the referral hospital

Eleven out of 16 cats had a CT scan of their bullae (68.8%), all of which had evidence of fluid in the bullae and four had bulla wall thickening. Four had MRI scans rather than CT (18.8%), of which 100% showed enhancing material in the bullae (see figure 2). Two cats had evidence of otitis interna (one showing enhancement of inner ear structures on post-contrast images; one having a large and distorted inner ear and enhancement of the semi-circular canals) and one of the two had concurrent meningitis.

Of the four cats that showed evidence of bulla wall thickening, one was treated medically with systemic itraconazole and a topical preparation containing polymyxin B, prednisolone and miconazole (Surolan®, Elanco, Basingstoke, UK), one underwent a ventral bulla osteotomy (VBO), one was recommended a VBO and one underwent total ear canal ablation (TECA). No recurrence was noted in the three cats that received treatment; no follow-up information was available for the cat that was recommended for VBO surgery.

Figure 2 - Flow diagram for 16 cats diagnosed with otitis media with a summary of the diagnostic methods



Five cats had myringotomy procedures. Nine had cytology performed on the aural exudate (4/9) or material obtained by myringotomy (5/9). Samples from 9/16 cases (56.3%) were sent for culture and sensitivity testing; a variety of organisms were cultured, including *Staphylococcus epidermidis* and *S. aureus* (with no significant antimicrobial resistance reported), *Escherichia coli*, anaerobes, *Pasteurella multocida*, *Mycoplasma spp.* and *Pseudomonas aeruginosa*. The specific organism did not appear to influence the treatment modality or outcome.

Table 1 – Bacterial culture and cytological findings

Micro-organism cultured	Aural exudate	Myringotomy	Cytological findings
Not cultured	1	0	Rods and cocci
<i>Staphylococcus epidermidis</i>	1	0	<i>Malassezia</i>
<i>Pasteurella multocida</i>	0	1	No bacteria
<i>Pseudomonas aeruginosa</i> and <i>Enterococcus faecalis</i>	0	1	<i>Malassezia</i>
<i>Escherichia coli</i> and mixed anaerobes	0	1	Rods
<i>Mycoplasma spp.</i>	1	0	No bacteria
<i>Staphylococcus aureus</i>	1	0	Not done
<i>Pasteurella multocida</i>	0	1	No bacteria
Culture negative	0	1	No bacteria
<i>Mycoplasma spp.</i> (cultured from nose)	0	0	Not done

### Treatment

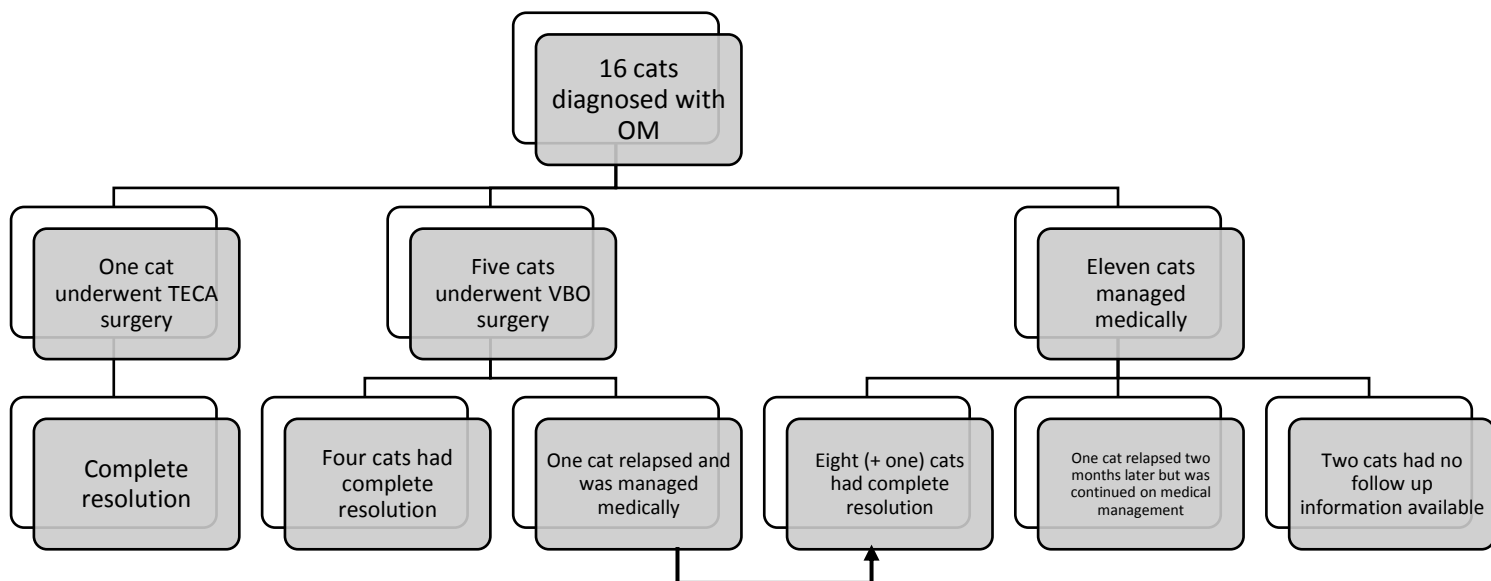
Of the 16 cats with OM, six were treated surgically and ten were managed solely medically. Seven of the cats managed medically were treated with systemic

antibiotics (cefovecin (1), marbofloxacin (1), clavulanate-potentiated amoxicillin (4, with one switched to clindamycin), pradofloxacin (1) and cefalexin (1)), based on the results of culture and sensitivity testing. Two were treated with systemic itraconazole and one also treated topically because *Malassezia spp.* were seen on aural exudate cytology. The duration of treatment ranged from 10 days to 8 weeks. See Table S1 for a summary of treatments received by each cat.

### Outcomes

One cat had a follow-up CT scan five weeks later and one had radiographs after one year; both these cats were successfully managed medically, with no signs of bulla effusion seen on the images, which had been present previously. Two cats had continual signs of OE after being medically managed, but no signs of OM. Six cats have had no signs of ear disease, either OE or OM, as far as follow up allows. One of the cats with concurrent otitis interna had continued ataxia and both had head tilt, though these signs were less pronounced than on initial presentation. Follow up available ranged from three months to two years. Four cats were euthanized, all for unrelated problems. For two cats, there was no available follow-up information (see figure 3).

Figure 3 – Flow diagram summarising the treatment outcomes for 16 cats diagnosed with otitis media



### Discussion

Managing OM in cats with surgical intervention has been well described;<sup>[10]</sup> to the best of the authors' knowledge there is very little information on medical management. This small retrospective study shows some evidence that medical management with systemic antibiotics can be successful in treating cats with OM. The nine cats that were managed medically, for which follow up was available, all

appear to have been successfully treated. These results are potentially valuable for making clinical decisions when managing similar cases in future.

Though there were no specific selection criteria in this study, it should be noted that diagnosis of OM in these cats was not solely based on imaging findings; the cats also had to have presented with compatible clinical signs. Previous studies have found that 34 cats out of a cohort of 100 had signs of OM on CT scans of the head yet presented with no signs consistent with ear disease.<sup>[14]</sup>

Studies show that CT and MRI are the most sensitive diagnostic imaging methods of diagnosing OM,<sup>[12]</sup> it is not, however, known if they are the gold standard method for monitoring for relapse. Resolution in these cases was based on resolution of clinical signs. Future prospective studies may wish to definitively measure resolution with a combination of advanced imaging techniques.

There is a lack of evidence regarding the use of non-steroidal anti-inflammatory drugs (NSAIDs) in OM cases, whether for analgesia or to reduce inflammation. Though in these cases, it was used mainly for post-surgical cases, there were some medically managed cats that also received NSAIDs. Each case was managed by clinicians from different specialities/disciplines so no standardised medical modality was used.

It is stated in some review articles that antimicrobial medication is a valid treatment option in both dogs and cats, while others state that topical or systemic antimicrobials are far from ideal in the treatment of OM.<sup>[5][7][17]</sup> These conflicting stances suggest that there is limited good quality evidence on how to use systemic antimicrobials to treat OM and in which situations they are more likely to succeed; with particularly limited evidence for feline patients, especially as most of the available evidence is anecdotal or opinion-based, rather than being based on clinical trials. In this study, the duration of antimicrobial therapy did not correlate with outcome, though some cats had shorter durations of treatment than a proposed length of 4-6 weeks.<sup>[18]</sup>

Some authors have stated that systemic antimicrobial therapies may not be able to reach a sufficient concentration in feline and canine bullae, even when given at the maximum oral dose.<sup>[5]</sup>

When planning to use systemic treatment in feline patients with OM; the results of bacterial culture are vital because this can influence which medication is prescribed.<sup>[18]</sup> Topical treatment may be effective even if culture indicates a resistant organism, due to the higher concentrations of drugs that can be applied topically to the ear, in comparison to systemic concentrations. In two cases described, infection with *Mycoplasma* was reported. *Mycoplasma* infection has also been reported as a cause for OM and *M. felis* is an increasingly recognised cause of disease in cats.<sup>[19][20]</sup>

This study is limited in that it was retrospective, not prospective; furthermore, the study population was very small. Even so we hope that it will help to form the basis for further studies evaluating the success or otherwise of managing OM in cats with systemic antimicrobial treatment.

## Conclusion



This small cohort shows that some cats with OM can be successfully managed medically. VBO and TECA are invasive surgical procedures that may not necessarily be required in these cases if appropriate medical management is undertaken.

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None

#### Conflicts of interest

The authors declared no potential conflicts of interest with respect to the research, authorship and publication of this article.

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#### Figure & Table legends

Figure 1 – Summary of the clinical signs recorded for 16 cats with a diagnosis of otitis media

Figure 2 - Flow diagram for 16 cats diagnosed with otitis media with a summary of the diagnostic methods

Table 1 – Bacterial culture and cytological findings

Figure 3 – Flow diagram summarising the treatment outcomes for 16 cats diagnosed with otitis media

Supplementary Information Table 1 – Summary of treatments received by 16 cats with otitis media

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#### Supplementary information

#### Supplementary Information Table 1 – Summary of treatments received by 16 cats with otitis media

Patient	Presenting signs	Diagnostics	Surgical or medical?	Antibiotics	Topical therapies	Steroids	Meloxicam	Systemic antifungal	Duration	Comments
1	Left sided OE, altered ear carriage, swelling, submandibular lymphadenomegaly, head shaking	CT, culture - negative	M	0	0	1	0	0	Unknown	Managed with topical medication at the referring surgery
2	Aural pruritus, ataxia, nystagmus	CT, myringotomy, cytology - neutrophils	M	cefovecin	0	0	1	0	4 weeks	No clinical signs reported
3	Right sided Horner's, ataxia, right sided OE	CT, myringotomy, culture - <i>Pseudomonas aeruginosa</i> , <i>Enterococcus faecalis</i> , cytology - eosinophils, neutrophils, <i>Malassezia</i>	M	0	Surolan®	0	0	itraconazole	4 weeks Surolan®, 6 alternate weeks itraconazole	No follow up available
4	Right sided OE	CT, cytology - <i>Malassezia</i> , culture - <i>Staphylococcus epidermidis</i> (ruptured TM)	S (TECA)	0	0	0	0	itraconazole	Unknown	No clinical signs reported
5	None	CT, cytology - rods and cocci	M	marbofloxacin	0	0	0	0	3 weeks	No clinical signs reported
6	Right sided Horner's syndrome - miosis, decreased palpebral reflex, no OE	CT	S	0	0	0	0	0	N/A	Euthanised for other reasons
7	Ceruminous exudate, head shaking, left sided head tilt, ataxia, reduced PLR and menace	MRI	S	cefalexin	0	0	1	0	4 weeks	Euthanised for other reasons
8	Ataxia, head tilt, horizontal nystagmus	MRI, cytology - neutrophils, culture - <i>Pasteurella multocida</i>	S	amoxyclav	0	0	1	0	8 weeks	Concurrent OI, no clinical signs reported
9	Ataxia, nystagmus, reduced oculocephalic reflex	MRI, myringotomy, cytology - neutrophils and intracellular <i>bacilli</i>	M	amoxyclav	0	0	1	0	10 days	Concurrent OI, no clinical signs reported
10	Previous OE, acute onset head shaking, sneezing	CT, cytology - <i>Mycoplasma spp.</i>	M	pradofloxacin	0	0	1	0	8 weeks	CT - resolved
11	Anisocoria, mydriasis, nystagmus, lymphadenomegaly, negative PLR, face scratching	MRI	M	amoxyclav	0	0	0	0	6 weeks	Euthanised for other reasons
12	Head twitching, mydriasis, OE	Culture - <i>Staphylococcus aureus</i>	M	cefalexin	0	0	0	0	3 weeks	No follow up available
13	Nasal discharge, upper respiratory noise, sneezing, anisocoria, mydriasis, miosis, 3rd eyelid protrusion, Horner's syndrome	CT, myringotomy, culture – <i>Mycoplasma spp.</i>	M	amoxyclav	0	0	0	0	4 weeks	X-rays - resolved
14	Aural pruritus, left sided head tilt, mild ataxia, altered ear carriage, head shaking, reduced palpebral reflex	CT	S then M	0	0	0	1	0	Unknown	Recurred after VBO, managed on Cefovecin
15	Ataxia, painful right ear	CT	S	0	0	0	1	0	Unknown	Euthanised for other reasons
16	Aural pruritus, difficulty swallowing/eating	CT	M	amoxyclav	0	0	1	0	2 weeks	No clinical signs reported

Amoxyclav – clavulanate-potentiated amoxicillin; CT – computed tomography; MRI – magnetic resonance imaging; OE – otitis externa; OI – otitis interna; TECA – total ear canal ablation; PLR – pupillary light reflex; Surolan (Elanco, Basingstoke, UK) containing polymyxin B, prednisolone and miconazole; VBO – ventral bulla osteotomy.

